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1) Pennsylvania Forestry Association
   Primer series
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2) The Zoological quarterly, 1903
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3) The zoological quarterly bulletin, 1904
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9) The American rose quarterly, 1932
MNS# PSt SNPaAg105.9

Author: Pennsylvania Forestry Association

Title: Primer series

Place of Publication: Philadelphia

Copyright Date: 1892?

Master Negative Storage Number: MNS# PSt SNPaAg105.1

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300 v. $c24 cm.
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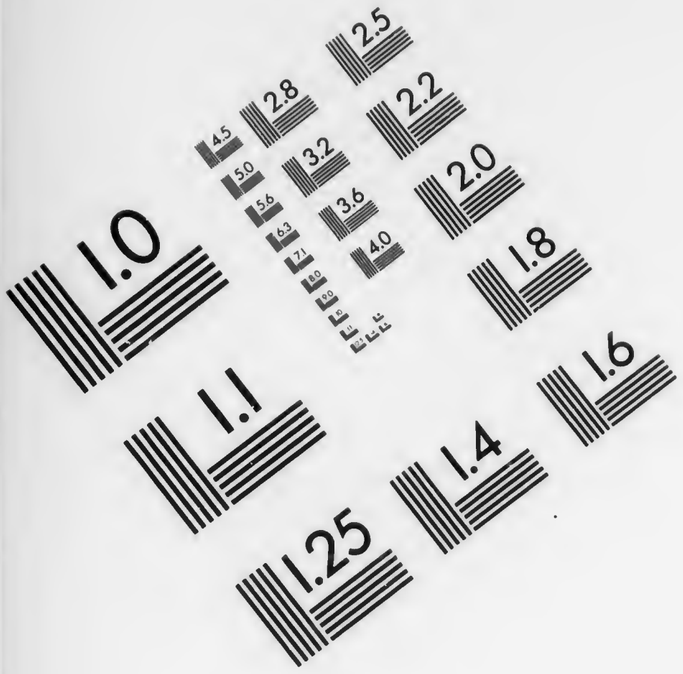

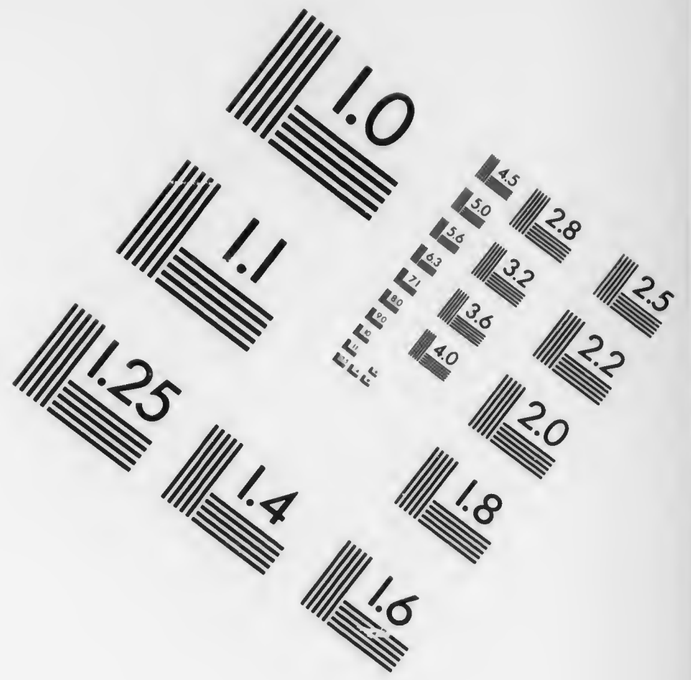

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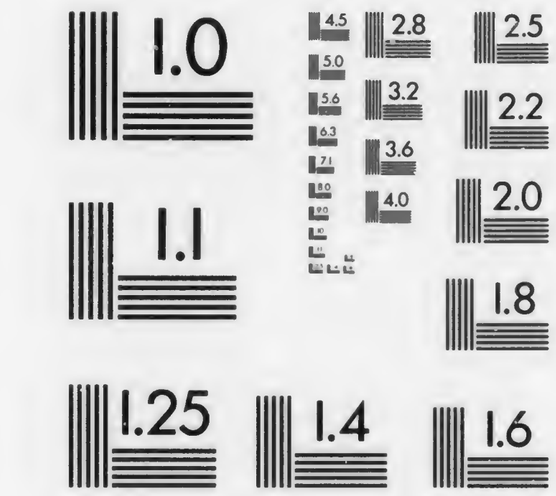

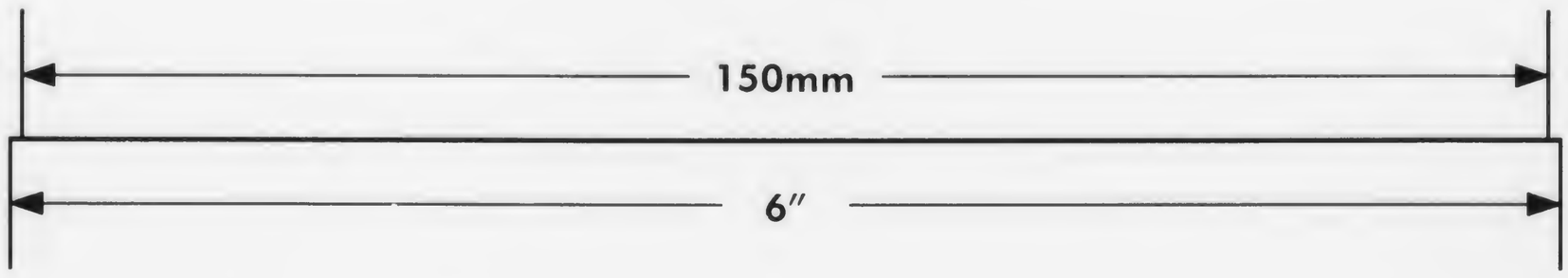

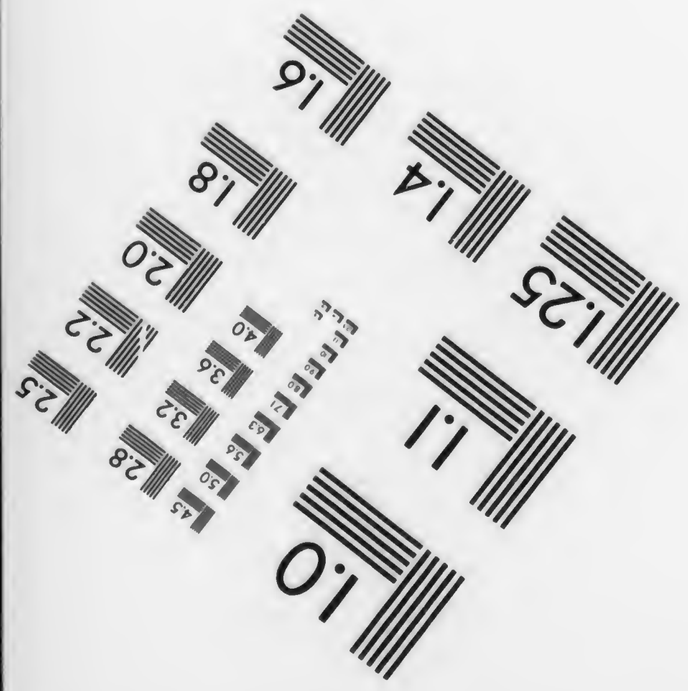

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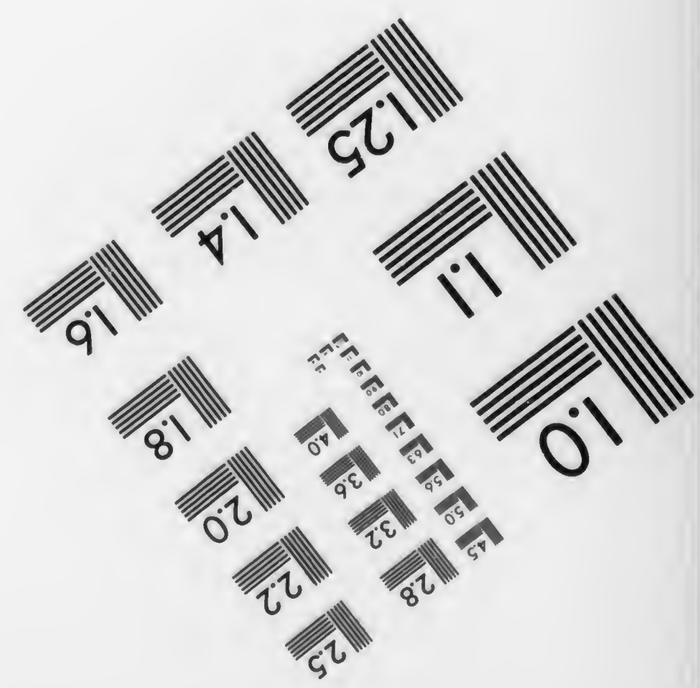

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Primer Series, No. 1.

Pennsylvania Forestry Association,

1012 WALNUT ST., PHILADELPHIA.

THE TEACHER AND THE FOREST.

Care for the Forest to most of us is a new thought. The word Forestry strikes us as strange, outlandish. That there should be such a body of related facts and of laws founded upon them;—a science of the woods which a state or nation has need of studying with care and patience on pain of the grievous loss of pure and wholesome air, of abundant streams, of fertile soil, and with the penalty of ravage by fire and drouth;—all this is new, and provokes the incredulous "Why?" "How?"

It is so short a time since in America the Forest was man's enemy. Its sombre billows of olive shade rolling from mountain to valley, and from valley to mountain again away into the blue-green distance, seemed to civilized man harsh and forbidding, for it meant too often a stealthy sudden foe, ambuscade, and death. The forest was the defense of savage man, and it also hid from the waiting earth the sun whose heat should beget abundant harvests for the various uses of civilization. So the settler rejoiced as with every axe-stroke danger moved westward and the wealth of a virgin soil overflowed. But Colonial days have long passed by with their sparse population, scattered on the narrow seaboard, the Alleghenies, covered with nnbroken forests, bounding civilization on the west, and the fear of Indian raids a constant reality. The feeble Colonies have become the great Republic with new conditions and new problems demanding intelligent consideration from thoughful minds and generous hearts all over the broad Union. Prominent among these problems is that of Forestry.

It is not now the *Forest* but the wanton, unregulated wasting of the Forest which is our menace. The danger approaches by many avenues of

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economic loss, each of one bringing national impoverishment in the near or the far future; the supply of water, the fertility of the soil, the balance of climate, the supply of lumber;—all have their ultimate relationship with the Forest. The sterile desolation which has visited other lands through violation of natural laws is a warning of the fate awaiting us, if our ignorance or heedlessness shall lead us to adopt a similar course. Nature inflicts her punishments with an absolute impartialty. The precise nature and details of this impending danger it is not my duty to state. That will be done by others who, upon a basis of exact knowledge, speak to the public of Pennsylvania through the medium of the Forestry Primers. The existence of that danger, however, cannot be doubted. How is it to be met and averted? Mainly by the enactment of State laws based upon a clear and accurate understanding of Forestry needs in this State; of laws framed with a scientific knowledge of what is really needful, and with a wise avoidance of what is not: partly by the wise action of private land owners in preserving a balance of woodlands on their farms. But the members of the legislature cannot be expected to enact laws for forest preservation unless their constituents make a strong demand that they shall do so; then, too, laws when enacted will not enforce themselves, they lie mute within the pages of the statute book, unless popular interest insists upon their being put into operation. A law without popular sentiment behind it pushing it into activity is like an engine without steam, or a gun without powder.

Now in this country the importance of Forestry is just beginning to dawn upon the public mind, the science of Forestry, which appeals so strongly both to our sense of natural beauty and to that of practical utility, has not been considered, far less understood, by any considerable number of thoughtful people.

There exists in Pennsylvania to-day no powerful organized sentiment capable either of enacting necessary forestry laws, or of securing the enforcement of those already enacted. How can such a sentiment be most quickly created? In no way so thoroughly as through the public schools of the State. If the forests of Pennsylvania are to be saved for the use of the children of future generations, the minds, and the hearts of the children of to-day must be appealed to; they must be taught that the fruit of ignorance and of greed which with fire and axe have wasted the noblest woods of this great State;—once so rich in timber, now dotted with bald and blackened mountain tops;—is irremediable impoverishment for generations to come.

Who shall teach the children this lesson but the teachers throughout the schools of the State?

There are thousands of true teachers in Pennsylvania, men and women, conscientious, enthusiastic, deeply imbued with a sense of the responsibility of their position, who are never content to exact only a *task* from the young minds under them, but who are always seeking to convey the inspiration of an *idea*, to awaken the sense of manly and womanly obligation, and to create in the child of to-day a thirst for the performance of the generous duties of citizenship when he shall have become the citizen of to-morrow.

Such a reform as in our country is required to save the forests, like all reforms in a democratic country, is mainly dependent upon the intelligent devotion and energy of a comparatively small number of men and women. It is a reform with an immense economic outcome, but for its inception it must appeal almost wholly to the ethical sense;—to those who thought they have received no benefit from posterity are yet content to confer one upon it.

Our appeal, then, is to those teachers of the public schools of Pennsylvania—quite unknown to us personally—unselfish, intelligent, who work in faith to make of their children real men and women, whose lives shall bless the future. To them we commit the large cause of Forestry, (which is in a word but wise care for the rich heritage of God-given trees,) with a faith as certain as their own that to no class of persons can we turn who will more faithfully or intelligently accept the trust.

We ask them, by use of those odd moments and opportunities, which are the seed time for true teachers—in the absence of more regular and systematic efforts—to imbue the minds of their scholars with a few simple principles as to the all important part which the Creator has given the Forest to play in the economy of nature, and to awaken in them a sense of responsibility for their coming power in Forest protection.

If the teachers of Pennsylvania will accept their share of this work the significance of the State's beautiful name will not be lost.

HERBERT WELSH.

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Primer Series, No. 2.

Pennsylvania Forestry Association.

1012 Walnut St., Philadelphia.

WASTED RESOURCES.

In the year 1700 a law was made in Pennsylvania, that a fence high enough and strong enough to prevent horses and cattle from escaping, should enclose each farm. That was one hundred and ninety-two years ago. The whole Atlantic seaboard was then densely covered with forests. No person could have thought, that by this time, our population would be so great as it is, or that the State of Pennsylvania would have less timber, than was actually required for home use.

Much less could it have been supposed that we would have been obliged to obtain our lumber from regions which were so far away, that they were then almost unknown, and which were inhabited only by wild Indians and wild animals.

The trees, two centuries ago, were an actual encumbrance to the ground, and were to be removed, and usually destroyed, that room might be made for planting crops upon which the food of the young colony depended.

The law then made was a wise one, because in building the fences two good ends were secured at the same time; that is, the trees removed, cleared the ground for crops, and were made into rails which enclosed and protected the farm against loose animals. It was not only the best kind of a law for that early period, but it was the only thing to do in self protection.

But times are constantly changing. What was right and useful in 1700 may be wrong and harmful in 1892. There may be no more reason why we should live under laws made two centuries ago than that we should be subject to England as our fathers were, when they made the laws. This was what our legislators in Harrisburg thought, when on the 4th of April 1889, they abolished the fence law of the year 1700

In spite, however, of the fact that farmers are no longer required by law to make fences against their own, or their neighbor's cattle, they are still doing it.

It is worth while to count the cost, and then to see whether it is wiser to make fences, or not.

There are in the State of Pennsylvania about 30,666 square miles devoted to farms. If you were to make a square of that large area of farming land, it would be just about 175 miles long and 175 miles wide. Suppose each one of

the farms contained 160 acres; or what is the same thing; suppose the farms would average half a mile long and half a mile wide; that would make in a tract of land 175 miles square, just four times as many farms as there are square miles. A little calculation will show you that there would be 122,664 farms.

To go around a farm which was one half a mile on each of its sides, would require *two* miles of fencing. The law, however, required that each farm should make but one-half of the boundary fences. Hence each farm would make one mile. In other words, there would be as many miles of boundary fences in length as there were farms in number. That, as you have seen, would be 122,664 miles of fences.

But we have still to consider the fences which divide the farm into fields. In the eastern part of our State, there are very commonly nine fields. Suppose them to be square (even though they are not always) we can see by making a diagram of such a farm, that there will be two miles of fencing (exclusive of the boundary fence) for the fields. That is, *in all*, 122,664 miles for the boundary fences, and 245,328 miles for the interior fences—which together sum up 367,992 miles.

Of course you cannot realize how long such a line of fences would be, if it were all spread out before you; but it will help you to comprehend the problem, when you remember that there are enough of fences in Pennsylvania to go around the world more than *fourteen* times.

In each mile there are 5,280 feet. In each panel of fence there are *ten* feet; consequently there are 528 panels of fence to the mile; or in 367,992 miles of fences there are 194,299,776 panels which at a cost of one dollar for each panel would reach the amazing figure of 194,299,776 dollars, as the cost of erecting the fences now standing in this State.

Or, suppose we estimate that a fence would last twenty-five years, then the value of the fences constructed each year in Pennsylvania would be $7,771,991 or on each one of the farms of the State, there would be expended about the average sum of $63 each year. This is a drain upon the resources of the State, because in the first place it represents so much wood to be cut and used. And in the second place, because it means the expenditure of labor and of money which could be better expended in some more productive way. It also, by reducing the profits on farming, discourages an industry in which the prosperity of the State most largely depends.

This condition of affairs is rendered much worse by the fact that in keeping up fences the woods on a vast number of farms have been so completely removed that the material for fences was brought from other regions. This involved an actual expense to the farmer and often obliged him to cultivate the acres so cleared in order that he might reap some benefit from them, when he would have done better to have farmed less ground more carefully, and allowed his trees to stand and protect the soil, save the water and aid in purifying the atmosphere.

Furthermore, much of the ground cleared in late years to obtain fencing material was poor, rough and hilly. But if farmed, it must have been enclosed and hence the crops produced often failed to render an adequate return for the labor and money expended.

You can easily see how much injury was thus brought to the State by enforcing a law unsuited to the present time.

The question now is, how can we best get rid of the old idea that fences are necessary? First of all, we may fairly conclude that our legislators carefully considered the case before they decided to free the farmers from the labor and expense of enclosing the farms. Our law makers must have felt that the old law was working harm to the State. Many of our wisest farmers had come to the same conclusion long before.

But what is to be done with the cattle now that the fences can be removed? First of all, the cattle can no longer be turned out into the public roads to wander at will. The roads were never intended for them, except as they were driven from place to place, and their presence was often a source of danger to people who were using the roads for the purposes for which they were made. There are two ways of caring for the cattle without injury to them and with actual profit to the farmer. First of all, movable fences are in use in many places. These can be made to enclose small areas and the cattle allowed to graze in such places until the pasture becomes insufficient. Then they can be moved so as to surround a fresh space, and the pasture be allowed to grow again until it is ready for use a second time. The mere fact that the destruction of forage caused by the tramping of the cattle is lessened by this method, is something to recommend it. Such fences would, year by year, cost less than it now does to maintain permanent fences over the whole farm.

Another method is to give the cattle a limited range, within a permanent enclosure, or "to soil them," as it is sometimes called, where the green food is cut and brought to them in the stable or in the enclosure.

Some of our best farmers who have tried this method, say that they can get food enough for cattle during both winter and summer, from an area which would only suffice to feed them during the summer, if they were allowed to run at large.

It is quite certain that where the population becomes, as it is fast doing, more dense, and the farms are correspondingly smaller, we ~~will~~ shall be obliged to adopt this method. Where it is now most used, it is true that labor is cheaper than with us; but on the other hand we cut our grass by machinery, which probably would more than compensate for the cheaper labor of other countries.

Where there are but few cattle, they can be tethered; or, as one may often see in populous parts of our country, people may club together and employ a herdsman.

In many places, where fences are used, hedges would not only be as cheap, and answer as well, but they would beautify the landscape. This may be regarded as a small thing, but whatever improves the appearance of a region increases the value of land in it.

Wire would at least spare the trees which we need much more for other purposes than fences, and so aid in diminishing the waste of our resources.

J. T. ROTHROCK.

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Primer Series, No. 3.

Pennsylvania Forestry Association,

1012 WALNUT ST., PHILADELPHIA.

REMOVE THE TAX FROM TIMBER LAND.

A Senator of the United States once remarked in a public meeting that in our North-Western States, the taxes on the forests were so high, that the owners of the lands were obliged to cut the timber to derive a revenue from the lands; that they could not afford to pay the taxes. Then he added: "when the white pine is cut off, it is not reproduced. I think we shall soon have destroyed it all."

Without explanation, any one can see, that if this is true, our taxes on forests are leading to destruction of timber, which is especially unfortunate in the case of the white pine, because it grows naturally only in North America, and is better adapted to certain uses than any other known species of tree. In other words, its extinction would to a certain extent, be an irreparable public loss.

But may it not be possible that there are other regions than our North-West in which taxes are working a public injury? For example, in the State of Pennsylvania, there are at least two thousand square miles of land, so poor, so rough and so hilly, that its cultivation will probably never be attempted. These areas are more or less densely covered with a growth of rock—oak, chestnut, locust, hemlock, white pine and pitch pine, with besides, a rather dense growth of underbrush.

The preservation of timber on these poorer parts of the State, is of vast importance, not only because of the future value of the trees as timber; but because they are the most active agents in properly protecting the high lands upon which we are so greatly dependent for the even flow of our streams which water and help almost the whole Commonwealth.

You will see by a glance at the map, in an instant, the importance of this. Philadelphia is supplied with water, the best part of which comes from mountains almost one hundred miles away. So, too, the great Susquehanna has its heads in the high, mountainous parts of the State.

There are two facts now to be remembered; first, that when water falls upon ground, which is well covered by trees, it is led by the leaves, branches and trunks to the ground quietly. There it becomes entangled by the fallen leaves, and soaks along the roots slowly, into the deeper parts of the ground, where it is secure from evaporation. From this water so saved by the trees, our supply comes in dry seasons.

The second fact is, that if these high ground forests are swept away, the melting snows and summer rains, will be much more likely to form such freshets as will do vast damage to the regions on the lower parts of the streams. Those who live in the Valley of the Juniata, for example, know the frequency and the destructiveness of these freshets, even as the adjacent mountains now are.

One might add a third fact in this connection. There is probably no known cause so powerful in supplying pure air, as our extensive woodland areas, and from them it is rapidly diffused over the country.

Here then, are three ways in which the public at large is benefited by the trees on our mountain sides. It is clear then, that you and I are interested as much in those trees as the owners, but the strange part of this relation is, that while we are all interested in those forests, the owner is obliged to pay all the taxes, and also to protect his lands against fire and tresspassers. Not only so, but when he pays a tax, it is for protection, yet he practically obtains nothing of the kind, for the laws against offenders who kindle forest fires are of but little real service.

If we were to be fair in regard to these important forests, the whole Commonwealth would aid in paying the taxes on them, so long as the owner allowed them to remain uncut. Or, what would be the same thing, the Commonwealth should remove the taxes. But we are told, that all private property must be taxed equally in proportion to its value. It is on this ground of equal taxation that I object to tax our forest lands. Is any tax equal where the public receives the benefit and the owner pays the whole tax. To make the tax equal, it should either be paid by the State, or be removed by the State.

Furthermore, taxation of timber land, so long as the trees remain uncut, is a violation of the principle in which taxation is founded, because the owner is receiving neither "rent, profit nor wages." Hence it is unjust.

But an objector remarks, the owner of those timber lands is holding them against a time when he shall receive an increased price for the trees. Very well! Then tax him on his revenue when he receives it; whether it be from a single tree or from an entire forest. There are known methods of obtaining taxes on income. Do not, by taxing him for waiting, drive him to despoil the State of trees, which are of infinitely greater value *to the State* than the tax received. This is actually being done in portions of this State, quite as much as it is in our North Western States.

To put the leading idea of this paper in plain form, we would say that:—

So long as land remains in the condition known as timber land, the owner or owners thereof, should pay no taxes upon it, except in so far as he or they, derive an actual revenue from it. In other words, the tax should be on the income and not on the property; because the owners are benefitted by the income, but the community by the property. This would be taxation on the basis of strict equity.

It will be well to add something more, lest misapprehension should follow. Nothing in what we have written is to be regarded as opposing any proper use of timber. When a tree is mature, it should be cut down. The country needs it. If it is allowed to fall and rot, it is practically a waste and a loss to the State;—and no one who understands the principles of Forestry, would advise or desire this.

Removal of a mature tree, however, is a very different thing from cutting down whole forests; big trees and little trees, all victimized in one wholesale slaughter. *There is now in this State but little land from which forests should be cleared for agricultural purposes.* Most of it will yield a larger return to the owners and to the State if it be kept in forest and the trees removed as they mature;—providing the owner is not driven by taxes to cut his trees.

Forestry also contemplates planting and protecting young trees on the rocky and poor soils from which they have been removed, Or if the planting be not required, then their protection against fire and roving animals should be provided for.

One is almost driven to think it would be wise in the State to encourage more liberally tree planting and tree protection by premiums. Certainly it would be unwise to discourage it by taxation. It should be remembered that there never can come a time when it would be well to remove all the forests from the poor ground on the heads of our great streams. It is then the duty of the State to guard against such a public calamity as this would be.

Destruction of hemlock forests, for the bark alone, might be partly obviated also by removal of taxes from timber land.

If some of our few counties in which there remains an excess of timber suffered by removal of woodland tax, so serious a drain upon their income as to retard their development, or to interfere with the administration of justice, then that deficiency should be made good by the State at large; just as the public schools in poorer counties are aided from the common fund: or as the United States government when it, by a general policy, produces an injury to a local interest, offers a premium in some shape to make amends. The reason for such a compensation in one case is the same as in the others: namely, the greatest permanent good to the greatest number.

J. T. ROTHROCK.

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Primer Series, No. 4.

Pennsylvania Forestry Association.

1012 Walnut St., Philadelphia.

CONDITIONS NECESSARY FOR THE GROWTH OF TREES.

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If a soil exist in any locality, and certain conditions of light, heat and moisture are present, the character of the vegetation that naturally grows in such a region will depend more on the peculiarities of the distribution of the heat, light and moisture, than on the character of the soil itself.

If the moisture be entirely absent, or if it exists in such a form, as for example as ice or snow, in which it cannot be readily appropriated by the plants, then that region becomes a desert.

Deserts occur either in dry, arid regions, or in the cold regions that exist on the higher mountain slopes amid the regions of perpetual snow.

If the moisture is absent during certain months of the year, and a rainfall occurs during the other months, that is, if one part of the year is dry and the rest is wet, the vegetable forms, which die or disappear during the dry season, reappear during the wet season. Portions of the earth that have this character of vegetation are called steppe region.

When the moisture does not fall as rain in very great amounts, but is fairly well distributed throughout the year, regions occur which are called prairies or meadows.

If there is an abundance of moisture at nearly all times throughout the year, and, for no very long time is such moisture absent, then the country may be covered by trees, and form what are called forest regions.

Forests cannot exist in the temperate zones of the earth in localities where, during the time of the trees' growth, a very long interval exists during which no rain falls. While the growth of the tree is suspended, as during the winter, this necessity for liquid nourishment of course no longer exists.

The reason forests cannot grow except where moisture is present nearly all the time the plants are growing will be easily understood from the following considerations:

Suppose a soil exists in any section of country, and suppose such soil contains plant germs of practically all varieties: then, when such a soil is submitted to the action of light, heat and moisture, these germs will be called into active life, and various forms of plant life will begin their existence.

Suppose this particular section to be a region where for several months of the year no rain falls. On the appearance of such a dry season all forms of plant life will disappear or die from want of proper nourishment.

On the reappearance of the wet season only those forms of plant life that have been able, during the brief time of the wet season, to reach their full growth and to produce their fruit or seeds, will be able to supply the germs necessary for a new growth. Such forms as trees, which, as is well known, require many years to mature their fruit or seed, will necessarily be unable to grow naturally in such a region of country.

Of course, it might easily happen that during the first wet season all the germs might not have been called into active life by the combined influence of the light and heat, so that on the next wet season such forms might spring up naturally. But their continued existence, under such circumstances, would be impossible from the absence of the new germs necessary to produce such plants.

Only those plants, therefore, can grow in a section of country where the rainfall is limited to certain periods of the year, that, during the time the rain continues and water is supplied to them, can reach their maturity and develop their seeds, so that they may be capable of reproducing the germ, and therefore be ready for the appearance of the next rainy reason.

For the growth of forests, a certain depth of soil and, in general, a certain character of soil is necessary. This soil may have been, in greater part, the result of prior generations of plants, and, in the beginning, forests could not grow in localities even where the proper conditions of light, heat and moisture are present, until such soil has been prepared for them.

Extensive forests, therefore, can exist naturally only in such regions where the rainfall during their time of growth is maintained with a certain approach towards regularity; that is, where trees are properly and continually supplied with their liquid nourishment.

It is mainly in the temperate regions of the earth that the great forest districts are to be found, since it is mainly in these regions that the rain may fall at almost any time of day and on almost any day of the year.

There are, however, extensive forest districts in parts of the tropical regions where the rainfall may occur at certain times during the day throughout nearly all the days of the year, even though the rest of the year is dry.

It is especially on the sides of mountains, where rain may fall in no matter from what direction the wind comes, that forests are to be found in nearly all portions of the earth's surface, provided the heat is sufficiently great, and a suitable soil is present. These conditions exist on nearly all mountain slopes outside of the polar regions.

The mountains may, therefore, be regarded as the natural home of the forests. The mountains are also the natural places where the rivers begin. The preservation of the forests on the sides of mountains is necessary for such a drainage of the rainfall as will best preserve the uniform flow of the rivers and will best prevent the rivers from overflowing their banks in times of rain, or becoming too shallow in times of drought.

The forests should be preserved and maintained on the sides of mountains. When it is necessary to cut down the forests for the sake of the timber they furnish, the trees should, in all cases, be replanted, so that forests shall not disappear from the face of the earth.

EDWIN J. HOUSTON.

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Primer Series, No. 5.

Pennsylvania Forestry Association.

1012 Walnut St., Philadelphia.

DRAINAGE.

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The rain that falls on the earth either runs directly off the surface or sinks into the ground.

The part that runs directly off the surface collects in small streams that discharge into a river, which finally discharges into some other river, into a lake, or directly into the ocean.

The part which sinks into the ground collects in pockets or places under the surface called reservoirs, from which, as a rule, it comes out at the surface at some lower level, as a spring. The flow of water in a river, during most of the time, is kept up by these springs pouring their waters into the many streams that empty into the river channel.

The water, therefore, that falls from the sky as rain flows directly from the earth's surface into a river, or it first collects in a reservoir, from which it afterwards flows into the river.

The running of the water from the higher level of the place where the rain fell to a lower level, is called drainage.

There are two kinds of drainage:

(1) Surface drainage, or where the rain water runs directly off the surface.

(2) Underground drainage, or where the rain water first sinks into the ground and then discharges into some stream that empties into a river.

Surface drainage takes place rapidly, and occurs mainly during the time rain is falling. It practically stops generally a few hours after the rain ceases.

Underground drainage takes place slowly and may continue for many weeks after the rain ceases.

All the water in a river comes from the rain that falls on the earth's surface. The river continues to flow because before all the water drains from the earth into the river, more rain falls and keeps up the supply.

Some rivers are larger than others. This is because—

(1) More rain falls on those parts of the earth through which they flow, and

(2) The land which slopes towards such rivers covers a greater part of the earth's surface.

The water runs off the earth from a higher to a lower level, because water runs down hill. The direction in which water will drain from the land will depend on the direction of the slope of the land.

If the land slopes so that all the water that drains from it collects in streams that flow into the ocean through a common river mouth, and the rainfall on such an area is large, the river itself will be large.

The smaller streams and rivers which collect in a single and larger river, and discharge their waters through a common mouth, are called collectively a river system.

The area of land that drains into a river is called a river basin.

The size of a river, therefore, depends upon the amount of the rain-fall on its basin, and on the size of its basin.

When the quantity of water discharged into a river is greater than its channel can hold, a flood occurs, or the river is said to inundate its banks.

A heavy rainfall does not necessarily produce an inundation; since if the character of the river basin is such that a comparatively small part shall run directly off the surface, and a large part shall sink into the ground, collect in the reservoirs of springs, and slowly pass through such springs into the rivers, sufficient time may be given for the river to discharge the waters of even a very heavy rainfall.

If, however, the character of the surface is such that the larger part of the rainfall runs directly off the slopes into the river channel, then an inundation must necessarily attend every heavy rainfall.

Whenever the greater part of the rainfall runs directly off the surface into the rivers, and a comparatively small part goes to feed the reservoirs of springs, if a comparatively long time elapses before the next rainfall, the springs will dry up, and the water in the river will get very low.

Any disturbance in the natural drainage of a country may cause a damage of two different kinds.

(1) The damage due to the overflowing of the rivers, or that due directly to too much water.

(2) The damage due to the drying up, or the getting low of the rivers, in the intervals between the storms, or that due to too little water.

The portion of the rainfall that sinks quietly into the earth as compared with that which flows directly from its surface depends on the character of the surface. As a rule, a surface devoid of vegetable covering, that is a surface on which no plants or other vegetation are growing, will permit a larger part of rainfall to drain directly into the river channels than will a surface covered by vegetation. This is especially the case during the colder parts of the year, when the ground is frozen.

When the rain falls on a surface covered by vegetation, the water, by slowly trickling down the stalks or stems of the leaves, branches and trunks of the trees, finds a ready entrance into the ground by following their surfaces and discharging into the porous ground lying outside their roots.

A forest, that is a section of ground covered by trees, permits this action to take place quite readily.

A forest, therefore, tends to decrease the frequency of floods, because it decreases the amount of the rainfall that drains directly from the earth's surface.

A forest also tends to prevent the occurrence of too little water in a river, because it ensures the filling of the reservoirs of springs, which discharge their waters into the rivers in the intervals between the rainfalls.

The forests must therefore be preserved in order that the rivers may properly aid in draining the earth.

EDWIN J. HOUSTON.

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